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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/693,127	10/24/2003	Lyon Brad King	066040-9764-00	1822

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EXAMINER	
KIM, TAE JUN	

ART UNIT	PAPER NUMBER
3746	

DATE MAILED: 06/03/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/693,127	KING, LYON BRAD	
	Examiner	Art Unit	
	Ted Kim	3746	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-30* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *14-21* is/are allowed.

6)☒ Claim(s) *1-9, 22-26, 30* is/are rejected.

7)☒ Claim(s) *10-13 and 27-29* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *04/19/2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-4, 22-24 are rejected under 35 U.S.C. 102(b) as being anticipated by Rogers et al (3,370,198). Rogers et al teach a thruster for use with an external power supply, the thruster comprising: a propellant 19 that exists in a non-gaseous state at standard temperature and pressure, the propellant having a melting point T_m, a boiling point T_b, and an evaporation rate; a reservoir 20 adapted to house the propellant, the reservoir selectively heated 22 to a temperature greater than T_m and less than T_b (note that the temperature of the cesium is taught as 100 °F in col. 3, lines 26+, which is believed to be below the boiling point); and a power control mechanism (col. 2, lines 10+; col. 3, lines 26+) positioned to control the amount of power from the external power supply being deposited into the reservoir to control the evaporation rate of the propellant; the propellant comprises a metal that exists in a solid state at standard temperature and pressure; the propellant comprises at least one of bismuth, mercury, cesium, cadmium, iodine, tin, indium, lithium and germanium.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1-4, 22-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rogers et al (3,370,198). Rogers et al teach a thruster for use with an external power supply, the thruster comprising: a propellant 19 that exists in a non-gaseous state at standard temperature and pressure, the propellant having a melting point T_m, a boiling point T_b, and an evaporation rate; a reservoir 20 adapted to house the propellant, the reservoir selectively heated 22 to a temperature greater than T_m and less than T_b (note that the temperature of the cesium is taught as 100 °F in col. 3, lines 26+, which is believed to be below the boiling point); and a power control mechanism (col. 2, lines 10+; col. 3, lines 26+) positioned to control the amount of power from the external power supply being deposited into the reservoir to control the evaporation rate of the propellant; the propellant comprises a metal that exists in a solid state at standard temperature and pressure; the propellant comprises at least one of bismuth, mercury, cesium, cadmium, iodine, tin, indium, lithium and germanium. While it is believed the range of operating below the T_b is taught, in order to obviate any doubt, it would have been obvious to one of ordinary skill in the art to employ a temperature below the boiling point as a well known range of operation where vaporization occurs.

5. Claims 1-9, 22-26, 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rogers et al (3,370,198) in view of the AIAA paper to Tverdokhlebov et al. Rogers et al teach various aspects of the claimed invention but do not teach the propellant is a Hall effect thruster. Hall effect thrusters using metal propellant are well known in the art, as evidenced by e.g. the Jankovsky et al paper or the Tverdokhlebov et al. It would have been obvious to one of ordinary skill in the art to employ the vaporized propellant of Rogers et al with a Hall effect thruster as a well known thruster employing vaporized metal propellants. Tverdokhlebov et al teach a Hall effect thruster with solid condensable metal and teaches the heat dissipation is 15-20 % of the total power (see page 6, 4th paragraph). The anode 1 (Fig. 1) is also the reservoir and vaporizer (page 3, see middle of left column), a cathode 6 is downstream of the body, and magnetic poles 4, 5 create a radial magnetic field. It would have been obvious to one of ordinary skill in the art to employ the anode as the reservoir and vaporizer, as taught by Tverdokhlebov et al. as a well known location for vaporization. The cathodes 2 or 3 or 6 can be read on the additional "electrode downstream of the reservoir which control at least one of the temperature of the reservoir and the evaporation rate of the propellant" as the current flows from the anode to the cathodes, hence, these electrodes/cathodes exert some measure of control over what occurs within the anode. It would have been obvious to one of ordinary skill in the art to employ the claimed range of dissipated heat to heat the reservoir, as an obvious matter of finding the workable ranges in the art.

6. Claims 1-9, 22-26, 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over the AIAA paper to Tverdokhlebov et al. in view of Rogers et al (3,370,198). Tverdokhlebov et al teach a thruster for use with an external power supply, the thruster comprising: a propellant that exists in a non-gaseous state at standard temperature and pressure, the propellant having a melting point T_m, a boiling point T_b, and an evaporation rate; a reservoir/anode 1 adapted to house the propellant (see page 3, middle of left column), the reservoir/anode selectively heated 1 to a temperature greater than T_m and less than T_b (note that the temperature of the Bismuth is taught to control the evaporation of the Bismuth); and a power control mechanism (inherent as the temperature is controlled) positioned to control the amount of power from the external power supply being deposited into the reservoir to control the evaporation rate of the propellant; the propellant comprises a metal that exists in a solid state at standard temperature and pressure; the propellant comprises at least one of bismuth, mercury, cesium, cadmium, iodine, tin, indium, lithium and germanium. Tverdokhlebov et al teach vaporizing the Bismuth but it is not taught to maintain the temperature below the boiling temperature. Rogers et al teach a thruster for use with an external power supply, the thruster comprising: a propellant 19 that exists in a non-gaseous state at standard temperature and pressure, the propellant having a melting point T_m, a boiling point T_b, and an evaporation rate; a reservoir 20 adapted to house the propellant, the reservoir selectively heated 22 to a temperature greater than T_m and less than T_b (note that the temperature of the cesium is taught as 100 °F in col. 3, lines 26+, which is believed to be below the boiling point); and

a power control mechanism (col. 2, lines 10+; col. 3, lines 26+) positioned to control the amount of power from the external power supply being deposited into the reservoir to control the evaporation rate of the propellant; the propellant comprises a metal that exists in a solid state at standard temperature and pressure; the propellant comprises at least one of bismuth, mercury, cesium, cadmium, iodine, tin, indium, lithium and germanium. It would have been obvious to one of ordinary skill in the art to employ a temperature below the boiling point in the Tverdokhlebov et al as a well known range of operation where vaporization occurs. Tverdokhlebov et al teach a Hall effect thruster with solid condensable metal and teaches the heat dissipation is 15-20 % of the total power (see page 6, 4th paragraph). The anode 1 (Fig. 1) is also the reservoir and vaporizer (page 3, see middle of left column), a cathode 6 is downstream of the body, and magnetic poles 4, 5 create a radial magnetic field. The cathodes 2 or 3 or 6 can be read on the additional "electrode downstream of the reservoir which control at least one of the temperature of the reservoir and the evaporation rate of the propellant" as the current flows from the anode to the cathodes, hence, these electrodes/cathodes exert some measure of control over what occurs within the anode.

Allowable Subject Matter

7. Claims 14-21 are allowed.

8. Claims 10-13, 27-29 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Contact Information

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Ted Kim whose telephone number is 571-272-4829. The Examiner can be reached on regular business hours before 5:00 pm, Monday to Thursday and every other Friday.

The fax numbers for the organization where this application is assigned are 703-872-9306 for Regular faxes and 703-872-9306 for After Final faxes.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Cheryl Tyler, can be reached on 571-272-4834.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist of Technology Center 3700, whose telephone number is 703-308-0861. General inquiries can also be directed to the Patents Assistance Center whose telephone number is 800-786-9199. Furthermore, a variety of online resources are available at http://www.uspto.gov/main/patents.htm

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